BUILDING ENERGY CODES UNIVERSITY

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Overview of the Changes to the Residential Provisions of the 2012 IECC

BUILDING TECHNOLOGIES PROGRAM

PNNL-SA-81398

2012 IECC Overview – Major Changes

- Summary of changes
  - ~30% better than 2006 IECC
  - Major changes
    - Consolidated with IRC energy chapter (actually a change to the IRC, not the IECC)
    - Mandatory whole-house pressure test
    - More stringent duct leakage test
    - DHW distribution system requirements
  - Minor changes
  - Key non-changes
    - Retains prohibition on envelope-equipment trade-offs
    - Makes lighting requirements “mandatory”

- Who Participated in the development of the 2012 IECC?

- *Everyone!*

- Goals:
  - DOE and several others submitted “comprehensive proposals,” all purporting to save 30% (relative to 2006)
    - Differences in format, flavor, accounting, etc.
    - Differences in level of savings

Structure of the 2012 IECC

Ch. 1 Scope and Application / Administrative and Enforcement
Ch. 2 Definitions
Ch. 3 General Requirements
Ch. 4 Commercial Energy Efficiency
Ch. 5 Referenced Standards
Index

Ch. 1 Scope and Application / Administrative and Enforcement
Ch. 2 Definitions
Ch. 3 General Requirements
Ch. 4 Residential Energy Efficiency
Ch. 5 Referenced Standards
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- 2012 IECC History
  - DOE and several others submitted “comprehensive proposals,” all purporting to save 30% (relative to 2006)
    - Differences in format, flavor, accounting, etc.
    - Differences in level of savings

Insulation and Fenestration Requirements by Climate Zone

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

TABLE R402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.35	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.35	0.55	0.40	49	20 or 13+5[h]	8/13	19	10 /13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.32	0.55	NR	49	20+5 or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall not be less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in Climate Zones 1 through 3 where the SHGC for such skylights does not exceed 0.30.

c. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Climate Zones 1 through 3 for heated slabs.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. First value is cavity insulation, second is continuous insulation or insulated siding, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulated siding. If structural sheathing covers 40 percent or less of the exterior, continuous insulation *R*-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness.

i. The second *R*-value applies when more than half the insulation is on the interior of the mass wall.

Requirements by Climate Zone

U-Factor Table

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

TABLE R402.1.3
EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
1	0.50	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.40	0.65	0.030	0.082	0.165	0.064	0.360	0.477
3	0.35	0.55	0.030	0.057	0.098	0.047	0.091[c]	0.136
4 except Marine	0.35	0.55	0.026	0.057	0.098	0.047	0.059	0.065
5 and Marine 4	0.32	0.55	0.026	0.057	0.082	0.033	0.050	0.055
6	0.32	0.55	0.026	0.048	0.060	0.033	0.050	0.055
7 and 8	0.32	0.55	0.026	0.048	0.057	0.028	0.050	0.055

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.

b. When more than half the insulation is on the interior, the mass wall *U*-factors shall be a maximum of 0.17 in Climate Zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.

c. Basement wall *U*-factor of 0.360 in warm-humid locations as defined by Figure R301.1 and Table R301.1.

Eave Baffle

Section R402.2.3

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

For air permeable insulations in vented attics, baffle

- ✓ Installed adjacent to soffit and eave vents
- ✓ To maintain an opening ≥ size of vent
- ✓ To extend over top of attic insulation
- ✓ May be of any solid material

Wood-Frame Walls
Section R402

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

TABLE R402.1.1
INSULATION AND FENESTRATION REQUIREMENT

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE
1	NR	0.75	0.25	30	13
2	0.40	0.65	0.25	38	13
3	0.35	0.55	0.25	38	20 or 13+5[h]
4 except Marine	0.35	0.55	0.40	49	20 or 13+5[h]
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]
6	0.32	0.55	NR	49	20+5 or 13+10[h]
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]

h. First value is cavity insulation, second is continuous insulation or insulated siding, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulated siding. If structural sheathing covers 40 percent or less of the exterior, continuous insulation R-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness.

Mass Wall Requirements

Section R402.2.5

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

TABLE R402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COM

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]
1	NR	0.75	0.25	30	13	3/4
2	0.40	0.65	0.25	38	13	4/6
3					or 13+5[h]	8/13
4 except Marine					or 13+5[h]	8/13
5 and Marine 4					or 13+5[h]	13/17
6					or 13+10[h]	15/20
7 and 8					or 13+10[h]	19/21

Second (higher) number applies when more than half the R-value is on the interior of the mass (i.e., when the thermal mass is insulated from the conditioned space)

Provisions

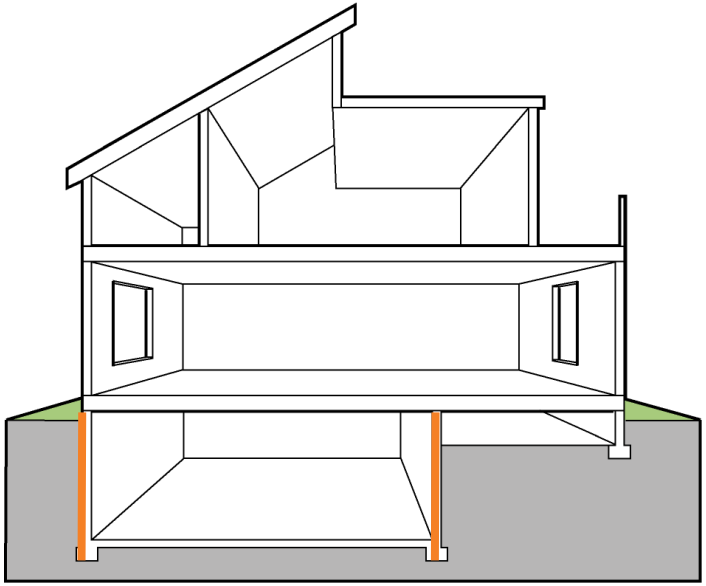
- ✓ When more than half the insulation is on the interior, the mass wall U-factors:

Climate Zones	U-Factor Minimum
1	0.17
2	0.14
3	0.12
4 except Marine	0.087
4 Marine and 5	0.065
6-8	0.065

Basement Walls

- ✓ ≥ 50% below grade
- ✓ Otherwise treat as above-grade wall

Climate Zones	R-Value
1-2	0
3	5/13
4	10/13
4c-8	15/19



Insulated from top of basement wall down to 10 ft below grade or basement floor, whichever is less

Steel-Frame Walls
Section R402.2.6

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

TABLE R402.2.6
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION
(*R*-VALUE)

WOOD FRAME *R*-VALUE REQUIREMENT	COLD-FORMED STEEL EQUIVALENT *R*-VALUE[a]
Steel Truss Ceilings[b]	
R-30	R-38 or R-30 + 3 or R-26 + 5
R-38	R-49 or R-38 + 3
R-49	R-38 + 5
Steel Joist Ceilings[b]	
R-30	R-38 in 2 × 4 or 2 × 6 or 2 × 8 R-49 in any framing
R-38	R-49 in 2 × 4 or 2 × 6 or 2 × 8 or 2 × 10
Steel-Framed Wall 16″ O.C.	
R-13	R-13 + 4.2 or R-19 + 2.1 or R-21 + 2.8 or R-0 + 9.3 or R-15 + 3.8 or R-21 + 3.1
R-13 + 3	R-0 + 11.2 or R-13 + 6.1 or R-15 + 5.7 or R-19 + 5.0 or R-21 + 4.7
R-20	R-0 + 14.0 or R-13 + 8.9 or R-15 + 8.5 or R-19 + 7.8 or R-19 + 6.2 or R-21 + 7.5
R-20 + 5	R-13 + 12.7 or R-15 + 12.3 or R-19 + 11.6 or R-21 + 11.3 or R-25 + 10.9
R-21	R-0 + 14.6 or R-13 + 9.5 or R-15 + 9.1 or R-19 + 8.4 or R-21 + 8.1 or R-25 + 7.7
Steel Framed Wall, 24″ O.C	
R-13	R-0 + 9.3 or R-13 + 3.0 or R-15 + 2.4
R-13 + 3	R-0 + 11.2 or R-13 + 4.9 or R-15 + 4.3 or R-19 + 3.5 or R-21 + 3.1
R-20	R-0 + 14.0 or R-13 + 7.7 or R-15 + 7.1 or R-19 + 6.3 or R-21 + 5.9
R-20 + 5	R-13 + 11.5 or R-15 + 10.9 or R-19 + 10.1 or R-21 + 9.7 or R-25 + 9.1
R-21	R-0 + 14.6 or R-13 + 8.3 or R-15 + 7.7 or R-19 + 6.9 or R-21 + 6.5 or R-25 + 5.9
Steel Joist Floor	
R-13	R-19 in 2 × 6, or R-19 + 6 in 2 × 8 or 2 × 10
R-19	R-19 + 6 in 2 × 6, or R-19 + 12 in 2 × 8 or 2 × 10

a Cavity insulation *R*-value is listed first, followed by continuous insulation *R*-value.
b. Insulation exceeding the height of the framing shall cover the framing.

Sunrooms

Less stringent insulation R-value and glazing U-factor requirements

Sunroom definition:

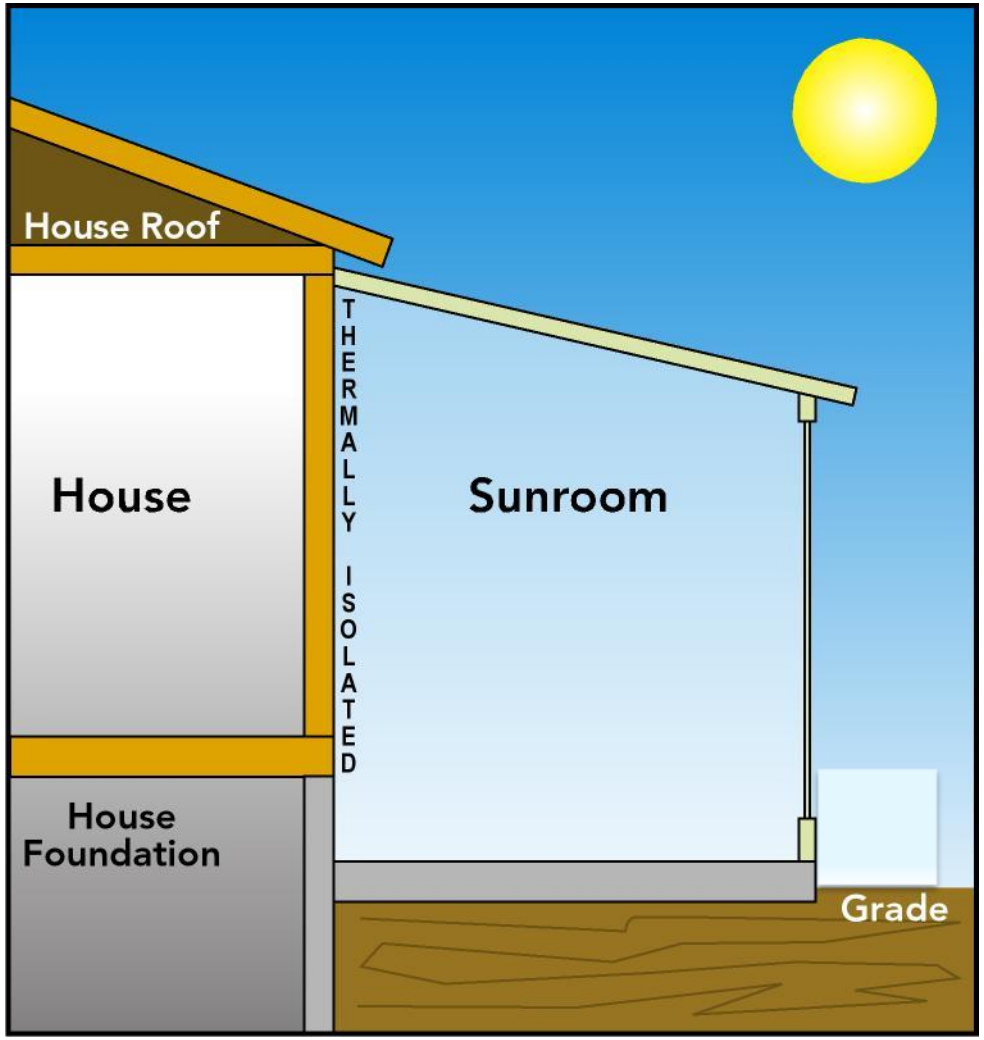
- ✓ One story structure
- ✓ Glazing area >40% glazing of gross exterior wall and roof area
- ✓ Separate heating or cooling system or zone
- ✓ Must be thermally isolated (closeable doors or windows to the rest of the house)
- ✓ Can always meet Table R402.1.1 requirements with unlimited glass

Sunroom Requirements

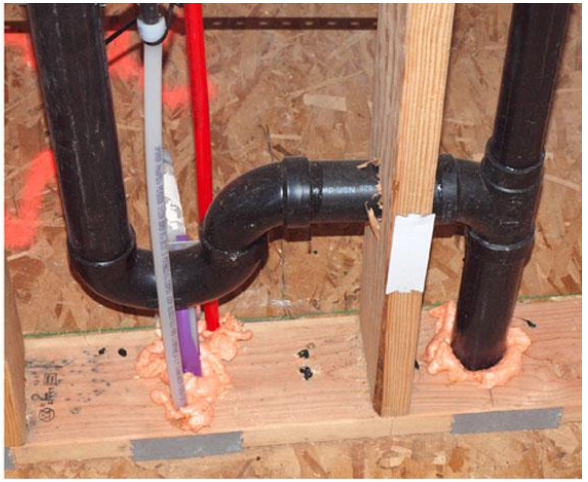
Section R402.2.12

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

- ✓ Ceiling Insulation
  - Zones 1-4 R-19
  - Zones 5-8 R-24
- ✓ Wall Insulation
  - All zones R-13
- ✓ Fenestration U-Factor
  - Zones 4-8 0.45
- ✓ Skylight U-Factor
  - Zones 4-8 0.70



Building thermal envelope



Two options to demonstrate compliance

✓ Whole-house pressure test

Air Leakage Rate	Climate Zone	Test Pressure
≤ 5 ACH	1-2	50 Pascals
≤ 3 ACH	3-8	50 Pascals

- Testing may occur any time after creation of all building envelope penetrations

✓ Field verification of items listed in Table R402.4.1.1

Building Thermal Envelope

Section R402.4.1 – Air Leakage

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

TABLE R402.4.1.1
AIR BARRIER AND INSULATION INSTALLATION

COMPONENT	CRITERIA*
Air barrier and thermal barrier	A continuous air barrier shall be installed in the building envelope. Exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed. Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier sealed. Access openings, drop down stair or knee wall doors to unconditioned attic spaces shall be sealed.
Walls	Corners and headers shall be insulated and the junction of the foundation and sill plate shall be sealed. The junction of the top plate and top of exterior walls shall be sealed. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier. Knee walls shall be sealed.
Windows, skylights and doors	The space between window/door jambs and framing and skylights and framing shall be sealed.
Rim joists	Rim joists shall be insulated and include the air barrier.
Floors (including above-garage and cantilevered floors)	Insulation shall be installed to maintain permanent contact with underside of subfloor decking. The air barrier shall be installed at any exposed edge of insulation.
Crawl space walls	Where provided in lieu of floor insulation, insulation shall be permanently attached to the crawlspace walls. Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.
Narrow cavities	Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be air tight, IC rated, and sealed to the drywall.
Plumbing and wiring	Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls, or insulation that on installation readily conforms to available space shall extend behind piping and wiring.
Shower/tub on exterior wall	Exterior walls adjacent to showers and tubs shall be insulated and the air barrier installed separating them from the showers and tubs.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical or communication boxes or air sealed boxes shall be installed.
HVAC register boots	HVAC register boots that penetrate building thermal envelope shall be sealed to the sub-floor or drywall.
Fireplace	An air barrier shall be installed on fireplace walls. Fireplaces shall have gasketed doors.

a. In addition, inspection of log walls shall be in accordance with the provisions of ICC-400.

Duct Sealing
Section R403.2.2 - Mandatory

- ✓ Sealing (Mandatory)
  - Joints and seams to comply with IMC or IRC
  - All ducts, air handlers, and filter boxes to be sealed *(Section R403.2.2)*

- Exceptions
  - No additional joint seals required for air-impermeable spray foam product
  - Where duct connection is partially inaccessible, 3 screws or rivets to be equally spaced on exposed portion of joint to prevent a hinge effect
  - Continuously welded and locking-type longitudinal joints and seams in ducts operating at static pressures < 2 in. w.c. pressure classification don't require additional closure systems

Duct Tightness Tests
Section R403.2.2

or

Duct Tightness Tests
Section R403.2.2

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Duct tightness shall be verified by either of the following:

- ✓ <u>Post construction test</u>
  - Total leakage: ≤4 cfm/per 100 ft^2 of conditioned floor area
    - tested at a pressure differential of 0.1 in w.g. (25Pa) across entire system, including manufacturer's air handler enclosure
  - All register boots taped or otherwise sealed
- ✓ <u>Rough-in test</u>
  - Total leakage ≤4 cfm/per 100 ft^2 of conditioned floor area
    - tested at a pressure differential of 0.1 in w.g. (25Pa) across roughed-in system, including manufacturer's air handler enclosure
    - all register boots taped or otherwise sealed
    - if air handler not installed at time of test
      - » Total air leakage ≤3 cfm/per 100 ft^2

<u>Exceptions</u>: Duct tightness test is not required if the air handler and all ducts are located within building thermal envelope

Sealed Air Handler

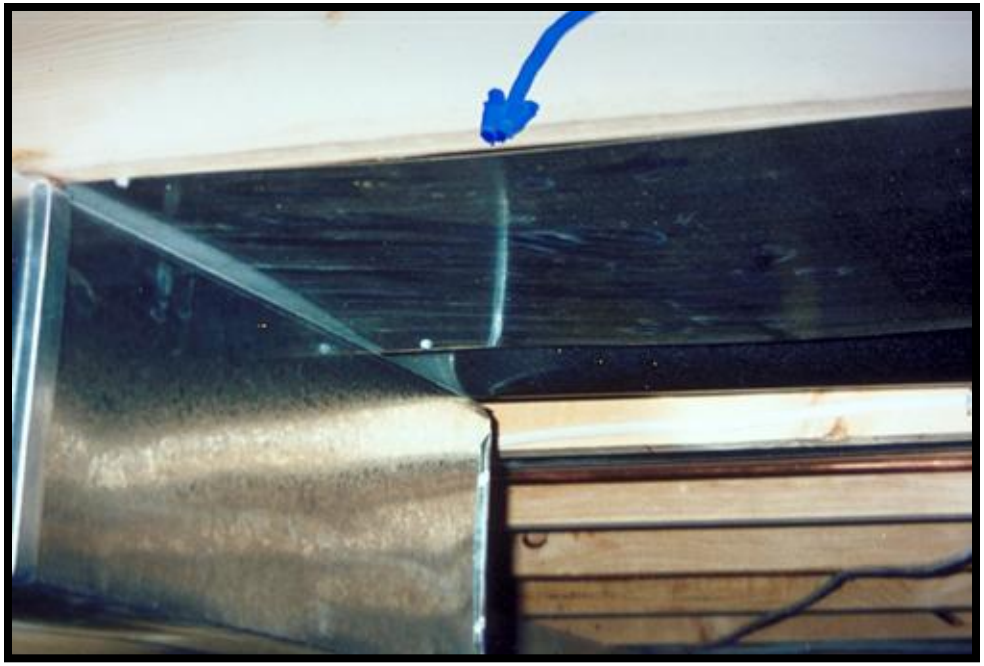
Section R403.2.2.1

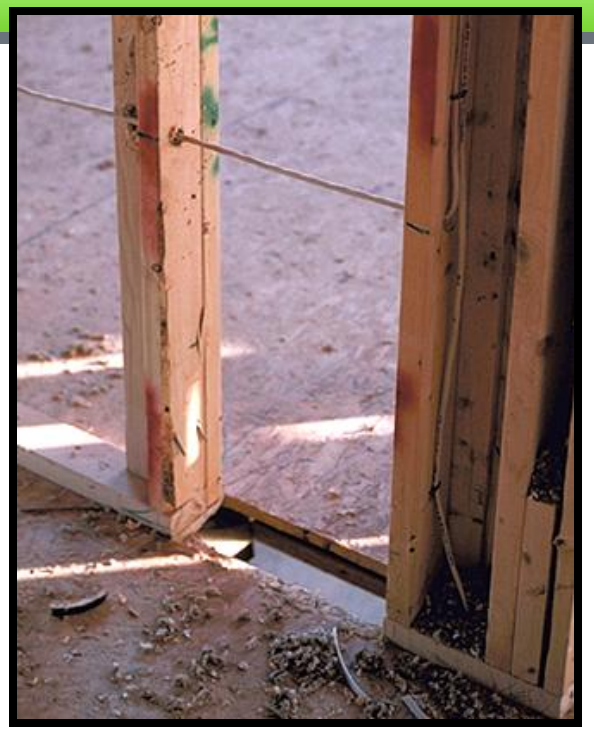
Air handlers to have a manufacturer's designation for an air leakage of ≤ 2% of design air flow rate per ASHRAE 193

Building Cavities
Section R403.2.3 - Mandatory

Framing cavities cannot be used as ducts or plenums

Building Cavities
Section R403.2.3 - Mandatory





Holes, big and small

Piping Insulation

Section R403.3 - Mandatory

- ✓ R-3 required on
  - HVAC systems
    - Exception: Piping that conveys fluids between 55 and 105°F
- If exposed to weather,
  - protect from damage, including
    - Sunlight
    - Moisture
    - Equipment maintenance
    - Wind
  - Provide shielding from solar radiation that can cause degradation of material
  - Adhesive tape is not allowed

Piping Insulation
Section R403.3

Image courtesy of Britt/Makela Group

- R-3 required on
  - Piping > ¾ in. nominal diameter
  - Piping serving more than one dwelling unit
  - Piping from the water heater to kitchen outlets
  - Piping located outside the conditioned space
  - Piping from the water heater to a distribution manifold
  - Piping under a floor slab
  - Buried piping
  - Supply and return piping in recirculating systems other than demand recirculation systems
  - Piping with run lengths > maximum run lengths for nominal pipe diameter in Table R403.4.2
- All remaining piping to be at least R-3 or meet run length requirements in Table R403.4.2

Piping Insulation

Section R403.3

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

TABLE R403.4.2
MAXIMUM RUN LENGTH (feet)[a]

Nominal Pipe Diameter of Largest Diameter Pipe in the Run (inch)	3/8	1/2	3/4	> 3/4
Maximum Run Length	30	20	10	5

For SI: 1 inch = 25.4 mm, 1 foot 304.8 mm.

a. Total length of all piping from the distribution manifold or the recirculation loop to a point of use.

- ✓ Ventilation
  - – Building to have ventilation meeting IRC or IMC or with other approved means
  - – Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating
- ✓ Whole-house mechanical ventilation system fans to meet efficacy in Table R403.5.1
  - ✓ **Exception**
    - ✓ When fans are integral to tested and listed HVAC equipment, powered by electronically commutated motor

TABLE R403.5.1
MECHANICAL VENTILATION SYSTEM FAN EFFICACY

FAN LOCATION	AIR FLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY (CFM/WATT)	AIR FLOW RATE MAXIMUM (CFM)
Range hoods	Any	2.8 cfm/watt	Any
In-line fan	Any	2.8 cfm/watt	Any
Bathroom, utility room	10	1.4 cfm/watt	< 90
Bathroom, utility room	90	2.8 cfm/watt	Any

For SI: 1 cfm = 28.3 L/min.

M1507.3 Whole-house mechanical ventilation system. Whole-house mechanical ventilation systems shall be designed in accordance with Sections M1507.3.1 through M1507.3.3.

M1507.3.1 System design. The whole-house ventilation system shall consist of one or more supply or exhaust fans or a combination of such and associated ducts and controls. Where local supply or exhaust fans are used as part of such a system, they shall be tested and rated in accordance with HVI 916, and the fans' rated flow at 0.25 in w.c. static pressure shall equal or exceed the required ventilation rate determined by Section M1507.3.3. Outdoor air ducts connected to the return side of an air handler shall be considered to provide supply ventilation.

M1507.3.2 System Controls. The whole-house mechanical ventilation system shall be provided with controls that enable manual override.

M1507.3.3 Mechanical ventilation rate. The whole-house mechanical ventilation system shall provide outdoor air at a continuous rate not less than that determined in accordance with Table M1507.3.3(1).

Exception: The whole-house mechanical ventilation system is permitted to operate intermittently where the system has controls that enable operation for not less than 25% of each 4 hour segment and the ventilation rate prescribed in Table M1507.3.3(1) is multiplied by the factor determined in accordance with Table M1507.3.3(2).

TABLE M1507.3.3(1)
CONTINUOUS WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM AIRFLOW RATE REQUIREMENTS

Dwelling Unit Floor Area (square feet)	Number of Bedrooms				
	0-1	2-3	4-5	6-7	>7
	Airflow in CFM				
<1500	30	45	60	75	90
1501-3000	45	60	75	90	105
3001-4500	60	75	90	105	120
4501-6000	75	90	105	120	135
6001-7500	90	105	120	135	150
>7500	105	120	135	150	165

- ✓ Equipment Sizing
  - IECC references Section M1401.3 of the IRC
  - Load calculations determine the proper capacity (size) of equipment
    - Goal is big enough to ensure comfort but no bigger
  - Calculations shall be performed in accordance with ACCA Manual J & S or other approved methods

Pools and Inground Permanently Installed Spas

Section R403.9

- ✓ Heaters
  - – with a readily accessible on-off switch mounted outside heater so heater can be shut off without adjusting thermostat setting
  - – fired by natural gas not allowed to have continuously burning pilot lights
- ✓ Time switches (or other control method) to automatically turn off and on heaters and pumps according to a preset schedule installed on all heaters and pumps
- ✓ Note: heaters, pumps, and motors with built-in timers meet the requirement
  - – Exceptions
    - Public health standards requiring 24-hour pump operation
    - Pumps operating pools with solar-waste-heat recovery heating systems

On heated pools and in-ground permanently installed spas

✓ Vapor-retardant cover

Exception:

✓ If >70% of energy from site-recovered energy

A minimum of 75 percent of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps or 75% of permanently installed lighting fixtures to contain only high efficacy lamps

Exception:

- ✓ Low-voltage lighting

CFL Lighting Required

- Applies to permanently installed lighting fixtures
- Requires 50% to be
  - Compact Fluorescent
  - T-8 Linear Fluorescent
  - Meet minimum efficacy requirements
- Applies to interior and exterior lighting

- ✓ Permanently posted on or in the electrical distribution panel
- ✓ Don't cover or obstruct the visibility of other required labels
- ✓ Includes the following:
  - R-values of insulation installed for the thermal building envelope, including ducts outside conditioned spaces
  - U-factors for fenestration
  - SHGC for fenestration
  - Results from any required duct system and building envelope air leakage testing
  - HVAC efficiencies and types
  - SWH equipment

Certificate (cont'd)

Certificate lists "gas-fired unvented room heater", "electric furnace", or "baseboard electric heater", rather than listing an efficiency for those heating types